

## Incidence of emergency surgery in anterior abdominal wall hernias

Emergency surgery of hernias

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### Abstract

**Aim:** This prospective study was conducted to analyze the incidence of emergency surgery in anterior abdominal wall hernias (AWH).

**Material and Methods:** A total of 659 patients with anterior AWH were examined. Patients with anterior AWH who underwent elective or emergency surgery were included in the study. In this study, groin and non-groin hernias constitute anterior AWHs. Gender, age, anesthesia and repair methods, elective and emergency surgery, hernia types, side of groin hernias, recurrent or primary hernias were determined and recorded. Emergency surgery incidences of hernias were evaluated in terms of gender, age, hernia types, groin hernia sides, primary or recurrent hernias.

**Results:** Emergency surgery was performed in 64 patients (9.7%). The incidence of emergency surgery was found to be higher in females. In anterior AWHs, the emergency surgery incidence was found to be higher in non-groin hernias than in groin hernias ( $P<0.001$ ). The emergency surgery incidence was highest in femoral hernias among groin hernias and incisional hernias in non-groin hernias. In terms of primary and recurrent cases, the emergency surgery incidence was significantly higher in recurrent cases ( $P<0.001$ ). However, when the emergency surgical incidence of all anterior AWHs such as inguinal, femoral, incisional, umbilical and epigastric hernias in the study were compared, no significant difference was found among them.

**Discussion:** Emergency surgery incidence was found to be higher in females and in recurrent cases. However, there was no significant difference in the incidence of emergency surgery among all anterior AWH types.

### Keywords

Abdominal Wall Hernia, Groin Hernia, Inguinal Hernia, Incarceration, Emergency Surgery

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## Introduction

A hernia is a condition in which abdominal tissues or organs, surrounded by the peritoneum, protrude from the abdominal wall through a defect in the abdominal wall. Abdominal wall hernia (AWH) is common in the community with a prevalence of 1.7%. Inguinal hernia constitutes most of the AWHs (75%) [1]. Every year, approximately 20 million people in the world are operated for inguinal hernia. In the United States of America and Germany, 350,000 and 100,000 abdominal hernia operations are performed each year, respectively [2]. Over time, the incidence of abdominal hernias has increased and the surgical techniques used have also improved. For this reason, operations of AWH have increased the interest of many surgeons on this subject [3].

Incarceration is the inability to push the contents of the hernial sac back into the abdomen. In the case of strangulation, the blood circulation of the structures in the hernia sac is disturbed and this situation is quite serious [4]. Incarcerated AWHs, a common surgical emergency, constitute 5-15% of AWHs. The most of incarcerated abdominal hernias are incarcerated groin hernias (IGH) [5].

We conducted this prospective study to analyze the incidence of AWHs that are incarcerated and require emergency surgery.

## Material and Methods

Our prospectively designed study was initiated after approval by the ethics committee. The study protocol was approved by the Inonu University Malatya Clinical Research Ethics Committee (No. 2018/161). This study was started in December 2018 and finished in December 2021. After obtaining ethical approval for the study, informed consent was obtained from each subject. The period in which this study was conducted also includes the period when the SARS-COV 2 epidemic in Turkey was severe. Patients who were admitted to the hospital due to anterior AWH and were operated on as an elective or emergency were included in the study. In this study, groin and non-groin hernias constitute anterior AWHs. Anatomically, hernias in regions other than the anterior abdominal wall were excluded. Gender and age of the patients, anesthesia and repair methods, patients undergoing elective and emergency surgery, hernia types, side of groin hernias, recurrence, or primary hernias were determined and recorded.

The incidence of hernias requiring emergency surgery was evaluated in terms of gender, age, hernia types, groin hernia sides, primary or recurrent hernias.

### Statistical Analysis

The normality of the continuous data was evaluated by the Shapiro-Wilk test and the independent samples t-test was used for comparisons. Categorical data were represented by numbers and percentage. Comparisons due to these variables were performed by Pearson's chi-square test or continuity-corrected chi-square test, where appropriate. In all analyses, a two-tailed significance level was considered as 0.05. Statistical analysis was performed using IBM SPSS Statistics for Windows version 22.0 (New York, USA).

### Ethical Approval

Ethics Committee approval for the study was obtained.

## Results

A total of 659 patients with anterior AWHs who underwent elective and emergency surgery in the hospital were included in the study. Four hundred seventy-four (72%) patients were male and 185 (28%) were female. The age range of the patients was 15-102 years, and the mean age was 50±12.2 years. The age range of male patients was 15-102 (50.4±13.2 ) and female patients was 17-82 (49±10.5 ).

Of the patients, 135 (20.5 %) were operated with general anesthesia and 524 (79.5%) were operated with regional anesthesia. Mesh herniorrhaphy was applied to 625 patients (94.8%), and the remaining 34 patients (5.2%) underwent primary herniorrhaphy.

Elective surgery was performed in 595 patients (90.3%), and emergency surgery was performed in 64 patients (9.7%) due to incarceration. Thirty-four male and 30 female patients underwent emergency surgery.

Groin hernia count was 575. Groin hernias consisted of 540 inguinal (indirect, direct and pantaloon hernias) and 35 femoral hernias. The number of non-groin hernias was 84 in total.

**Table 1.** Hernia types

Hernia Types	n	%
Inguinal hernia	540	81,9
*Indirect inguinal hernia	290	53,7
*Direct inguinal hernia	122	22,6
*Pantaloon hernia	128	23,7
Femoral hernia	35	5,3
Incisional hernia	44	6,7
Umbilical hernia	33	5
Epigastric hernia	7	1,1
Total	659	100

\*Types of inguinal hernia, n: Count.

**Table 2.** Emergency and elective surgery numbers and percentages in hernias

	Elective Surgery (n/%)	Emergency Surgery (n/%)
Groin Hernia	531 (92,3)	44 (7,7)
Inguinal hernia	507 (93,9)	33 (6,1)
*Indirect inguinal hernia	263 (90,7)	27 (9,3)
*Direct inguinal hernia	121 (99,2)	1 (0,8)
*Pantaloon hernia	122 (95,4)	5 (4,6)
Femoral hernia	24 (68,6)	11 (31,4)
Non-groin Hernia	64 (26,2)	20 (23,8)
Incisional hernia	30 (68,2)	14 (31,8)
Umbilical hernia	27 (81,8)	6 (18,2)
Epigastric hernia	7 (100)	0 (0)
Right-sided hernia	260 (90,5)	27 (9,5)
Left-sided hernia	154 (92,4)	13 (7,6)
Primer hernia	522 (93,4)	37 (6,6)
Recurrent hernia	73 (73)	27 (27)

\*Types of inguinal hernia, n: Count

**Table 3.** Comparison of variables in terms of emergency surgery

	Emergency Surgery	P value
Male	7.2%	<0.001
Female	16.2%	
Mean male age	68.2±12.4 years	0.009
Mean female age	59±15 years	
Groin hernias	7.7%	<0.001
Non-groin hernias	23.8%	
Femoral hernias	31.4%	< 0.05
Incisional hernias	31.8%	
Inguinal hernias	6.1%	
Direct hernias	0.8%	0.004
Indirect hernias	9.3%	
Right-sided	9.5%	0.613
Left-sided	7.6%	
Primer hernia	6.6%	<0.001
Recurrent hernia	27%	

Non-groin hernias consisted of incisional hernias (21 median, 8 Pfannen-stiel, 4 right paramedian, 3 suprapubic, 2 Mc Burney, 2 sub-umbilical trocar, 2 right subcostal and 1 left subcostal incision), umbilical hernias and epigastric hernias. The number and percentage of hernia types were shown in Table 1.

The number of right groin hernias was 287 (44.6%), left 167 (29%), and bilateral 121 (21%). There were 559 primary hernias (84.8%), and 100 recurrent hernias (15.2%). The age range of the patients who underwent emergency surgery was between 28 and 102 years. The mean age was 59.4±16.1 years. 45.3% of these patients were over 65 years of age, and 54.7% were under 65 years of age. The age range of emergency surgery was 35 - 102 years in males, 28- 82 years in females. The mean age was 68.2±12.4 years in males, 59±15 years in females.

Tissue resection was performed in 47 of 64 patients. The tissue resections of 34 omentum, 9 resections of the small bowel, 3 resections of omentum and small bowel, and 1 resection of omentum and appendix vermiformis were performed.

In groin hernia, the number of emergency surgery was 44, and the number of elective cases was 531. Tissue resection was performed in 28 patients with groin hernias (21 omentum resections, 4 small bowel resections, 2 omentum and small bowel resections, 1 omentum and appendix vermiformis resection). While the rate of small bowel resection was 1% in groin hernias, this rate was 13.6% in incarcerated groin hernias (IGH).

In non-groin hernias, the number of emergency surgery was 20, and the number of elective surgery was 64. Tissue resection was performed in 19 patients with non-groin hernias (13 omentum resections, 5 small bowel resections, 1 omentum and small bowel resection). The rate of small bowel resection was 7.1% in non-groin hernias, this rate was 30% in incarcerated non-groin hernias.

The number and percentage of elective and emergency surgery in groin hernias (inguinal, indirect inguinal, direct inguinal, pantaloon, femoral), non-groin hernia (incisional, umbilical, epigastric hernias), sides of hernia, primer, and recurrent hernias are shown in Table 2.

Tissue resection was performed in twenty patients with inguinal hernias (14 partial omentectomy, 3 small bowel resection, 2 partial omentectomy and small bowel resection, 1 partial omentectomy and appendix vermiformis resection). In thirteen patients, the hernia contents were reduced into the abdomen because there was no necrosis. Small bowel resection rate was 0.9 % in inguinal hernias, this rate was 15.1% in incarcerated inguinal hernias.

An emergency operation was performed for the femoral hernias, seven of them underwent partial omentectomy and 1 small bowel resection. The rate of small bowel resection was 2.8% in femoral hernias, this rate was 9% in incarcerated femoral hernias.

We detected incisional hernias in 21 median, 8 Pfannenstiel, 4 right paramedian, 3 suprapubic, 3 Mc Burney, 2 sub-umbilical, 2 right subcostal and 1 left subcostal incisions. Incisional hernias that underwent emergency surgery were 8 median, 2 Pfannenstiel, 2 right paramedian and 2 Mc Burney incisions. Partial omentectomy was performed in eight of them and small bowel resection in four of them. Small bowel resection rate was 9% in incisional hernias, this rate was 28.5% in incarcerated incisional hernias.

In umbilical hernias, 2 partial omentectomy, 1 small bowel resection, and 1 omentum and small bowel resection were performed due to necrosis. The rate of small bowel resection was 6% in umbilical hernias, this rate was 33.3% in incarcerated umbilical hernias.

The rate of emergency surgery in femoral and incisional hernias was found to be significantly higher than in inguinal hernias ( $P<0.05$ ). Emergency surgery rates were compared in indirect inguinal, direct inguinal, and femoral hernias, and a significant difference was found among them ( $P<0.001$ ).

Gender, age, hernia types (groin, non-groin, femoral, incisional, inguinal, direct, indirect), hernia sides, primary and recurrent emergency surgery rates are compared in Table 3.

In addition, the emergency surgery incidences of inguinal, femoral, incisional, umbilical and epigastric hernias, which are the anterior AWHs included in our study, were compared, and no statistically significant difference was found between them.

## Discussion

Abdominal wall hernias (AWH) are the most common surgical diseases in the general surgery department [6]. AWH operations are generally performed in middle-aged patients and mostly in the male gender (53.5%) [7]. The mean age of our patients was 50±12.2 years and most of them were male patients (72%).

It has been reported that 5-13% of incarceration will be seen in anterior AWH and emergency surgery will be performed [8]. Bowel necrosis may develop in 10-15% of incarcerated patients and bowel resection can be performed urgently [9]. We performed emergency surgery for incarceration in 9.7% of anterior AWHs. Small bowel resection was performed in 18.7% of incarcerated cases, and this value was higher than the literature values.

According to the literature, emergency surgical procedures for incarcerated AWH were mostly applied to males. Eyvaz et al. reported that most of the emergency hernia cases (53%) were male [10]. In the study by Derici et al., 62.6% of the patients

who underwent emergency surgery due to incarcerated AWH were males and 37.4% were females [11]. In our case, 53.1% of the patients who underwent emergency surgery were males and 46.8% were females. In addition, we found that the incidence of emergency surgery on the anterior AWHs was significantly higher in females (16.2%) than in males (7.2%) ( $P < 0.001$ ).

Emergency surgeries of the anterior AWH are usually performed on the elderly. Harissis et al reported that the mean age of their patients who underwent emergency surgery for AWHs was 66.5 years (range 25-95) [12]. Venara et al. found the mean age of emergency surgery to be 74 (range: 18-109) [13]. The mean age of our patients who underwent emergency surgery was below the literature values of  $59.4 \pm 16.1$  years.

Most incarcerated abdominal hernias (50-80%) are incarcerated groin hernias (IGH). Bowel resection is performed in approximately 15% of IGH patients due to necrosis [5]. The annual risk of strangulation in groin hernia is approximately 1-3% [14]. On the other hand, Chen et al. found that the rate of bowel resection in incarcerated groin hernias was 21%, and they performed most of the resections in the elderly and females [15]. We encountered that IGH constituted 68.7% of incarcerated AWHs and the small bowel resection rate was 13.6% in IGH. Small bowel resection rate in IGH was lower than the literature value. IGH surgeries account for 5% to 15% of groin hernia surgeries [13]. Emergency surgery due to incarceration rate was found to be 7.7% in groin hernias and 23.8% in non-groin hernias in this study. Emergency surgery incidence in non-groin hernias was significantly higher than in groin hernias ( $P < 0.001$ ).

10% of patients with inguinal hernia undergo emergency surgery due to incarceration. It is stated that the risk of strangulation in inguinal hernias is between 0.29% and 2.9% [16]. We found that the rate of emergency surgery due to incarceration in inguinal hernias was 6.1%, and small bowel resection was performed due to strangulation in 0.9% of inguinal hernias. Indirect inguinal hernias constitute the majority of incarcerated inguinal hernias (89%) [4]. Likewise, we encountered that incarceration was most common in indirect hernias (81.8%). Also, the incidence of emergency surgery in indirect hernias was significantly higher than in direct hernias ( $P = 0.004$ ).

Femoral hernias are not common and constitute a small portion (3-4%) of all hernias. It has been observed that strangulation develops in more than one-third of femoral hernias. In addition, it was reported that the rate of emergency surgical intervention in femoral hernias is higher than in other hernias [17]. In the study by Alimoglu et al. involving 83 patients with femoral hernia, 71.2% of the patients were females. They performed emergency surgery in 36 patients (40%) and resected 17 of these patients [18]. In addition, Chen et al. reported that the risk of emergency surgery and bowel resection is higher in femoral hernias than in other hernias [19]. In our study, femoral hernias accounted for 5.3% of all AWHs. Females constituted 77.1% of patients with femoral hernia. In femoral hernias, both the rate of emergency surgery (31.4%) and the rate of small bowel resection (2.8%) were lower than the literature values.

The incidence of incisional hernia worldwide is not known exactly [20]. Incarceration is encountered in 6-15% of incisional hernias

[21]. Dietz et al. performed emergency surgery on 26 patients (6.5%) in a series of 401 incisional hernias. They performed bowel resection in seven patients (24.2%) who were operated on urgently [20]. In incisional hernias, our rate of emergency surgery (31.8%) was higher than the values found in the literature. At the same time, our rate of small bowel resection (9%) in incisional hernias was lower than in the literature.

Kulah et al. reported that they performed emergency surgery for 188 right-sided and 103 left-sided incarcerated inguinal hernias in their hernia series [22]. We performed emergency surgery for 27 incarcerated inguinal hernias on the right side and 13 on the left side. In our case, the rate of emergency surgery on the right side was 9.5% and on the left side was 7.6%. There was no significant difference between the right and left sides in terms of emergency surgery incidences ( $P = 0.613$ ).

In the study conducted by Bessa et al., eighteen (21.25%) of 80 patients who underwent emergency surgery for ventral incarceration had recurrent hernias [23]. Recurrent hernia was present in 27 (42.2%) of 64 patients who we performed emergency surgery for incarceration, and this result was higher than the literature value. Also, the rate of emergency surgery in patients with a recurrent hernia (27%) was significantly higher than in patients with a primary hernia (6.6%) ( $P < 0.001$ ) in this study.

In the light of literature findings, it is seen that femoral hernia is the most common anterior AWH in which emergency surgical intervention and bowel resection are performed [17-19]. However, we found that there was no statistically significant difference in the incidence of emergency surgery for all anterior AWH types in this study. This result we obtained contradicts the findings of the literature.

As stated in our study, many other results we obtained were also different from the literature values. We strongly believe that the difference between the results we obtained and the classical literature data may be due to the fact that this study was conducted during the SARS- COV 2 epidemic period and this epidemic affected the results.

The limitations of this study were that it was conducted during the SARS COV 2 epidemic, it was single-centered, and pediatric patients were not included in the study. Due to the prospective nature of the study, the fact that all the findings of the patients were obtained accurately and completely and this situation positively affected the results of the study constitutes the strength of the study.

### Conclusion

The incidence of emergency surgery in anterior AWHs was found to be higher in females and in recurrent cases. Surgical emergencies incidence in non-groin hernias was significantly higher than in groin hernias. The femoral hernia had the highest incidence of emergency surgery in groin hernias and incisional hernia in non-groin hernias. There was no significant difference between the incidence of emergency surgery for all types of anterior AWHs.

In addition, according to our findings, it was concluded that the surgical priorities of inguinal, femoral, incisional, umbilical and epigastric hernias in the anterior abdominal wall are equal in elective conditions.

**Scientific Responsibility Statement**

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

**Animal and human rights statement**

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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**Conflict of interest**

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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